FIG. 1

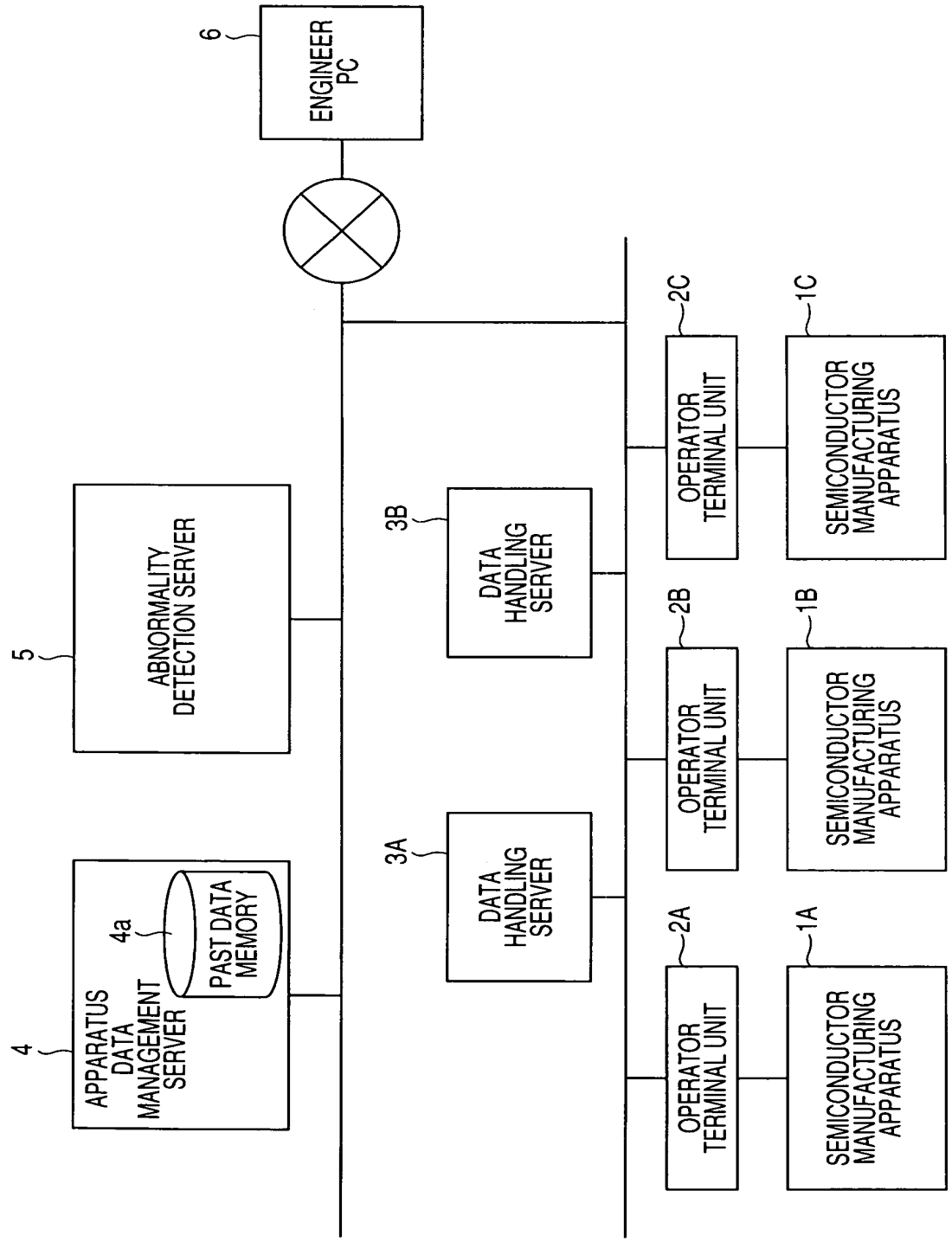

6
ENGINEER PC
5
ABNORMALITY DETECTION SERVER
4
APPARATUS DATA MANAGEMENT SERVER
4a
PAST DATA MEMORY
3B
DATA HANDLING SERVER
3A
DATA HANDLING SERVER
2C
OPERATOR TERMINAL UNIT
2B
OPERATOR TERMINAL UNIT
2A
OPERATOR TERMINAL UNIT
1C
SEMICONDUCTOR MANUFACTURING APPARATUS
1B
SEMICONDUCTOR MANUFACTURING APPARATUS
1A
SEMICONDUCTOR MANUFACTURING APPARATUS

FIG. 2

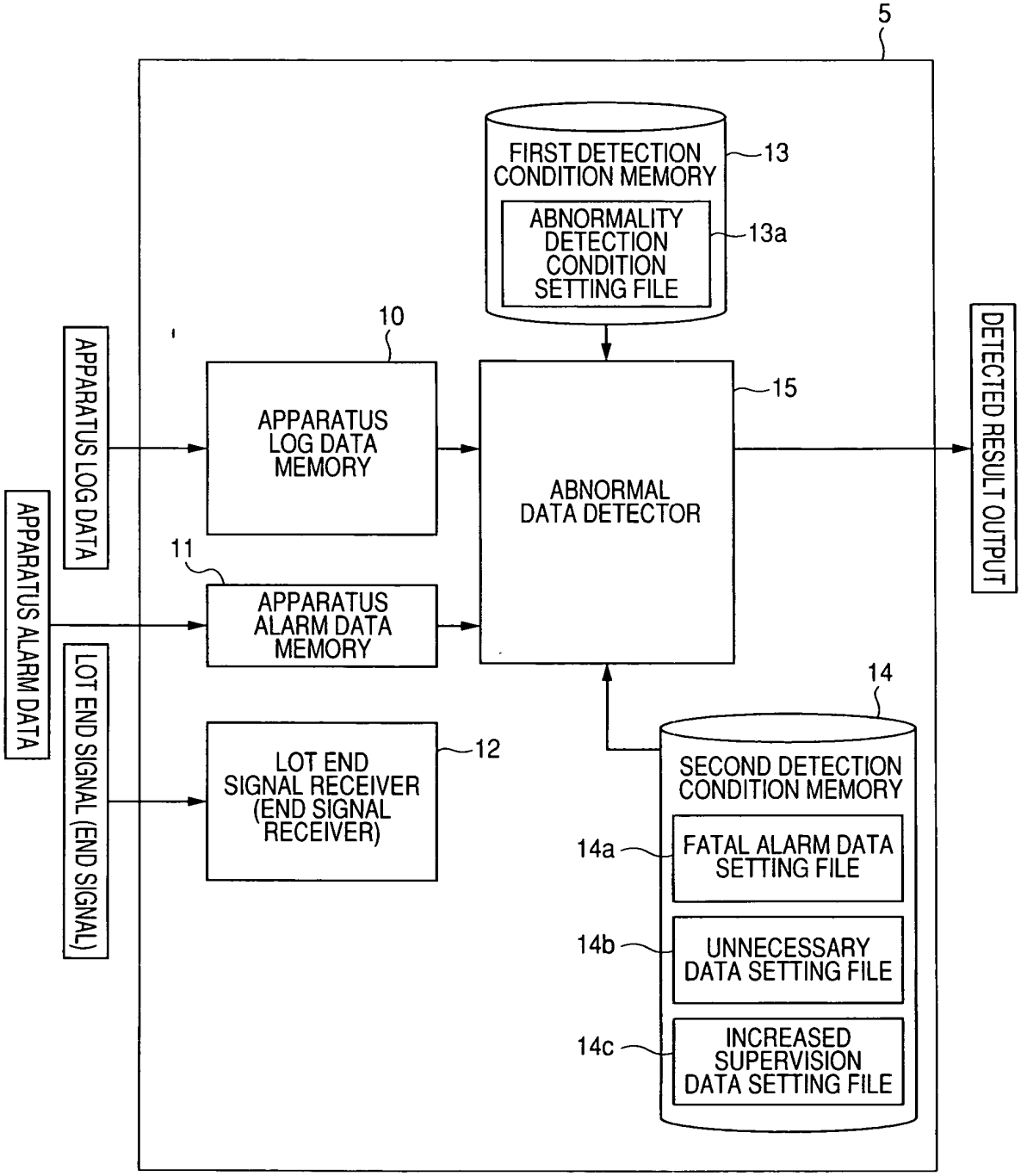

5
FIRST DETECTION CONDITION MEMORY
13
ABNORMALITY DETECTION CONDITION SETTING FILE
13a
10
APPARATUS LOG DATA MEMORY
15
ABNORMAL DATA DETECTOR
DETECTED RESULT OUTPUT
APPARATUS LOG DATA
APPARATUS ALARM DATA
11
APPARATUS ALARM DATA MEMORY
LOT END SIGNAL (END SIGNAL)
LOT END SIGNAL RECEIVER (END SIGNAL RECEIVER)
12
14
SECOND DETECTION CONDITION MEMORY
14a
FATAL ALARM DATA SETTING FILE
14b
UNNECESSARY DATA SETTING FILE
14c
INCREASED SUPERVISION DATA SETTING FILE

FIG. 3

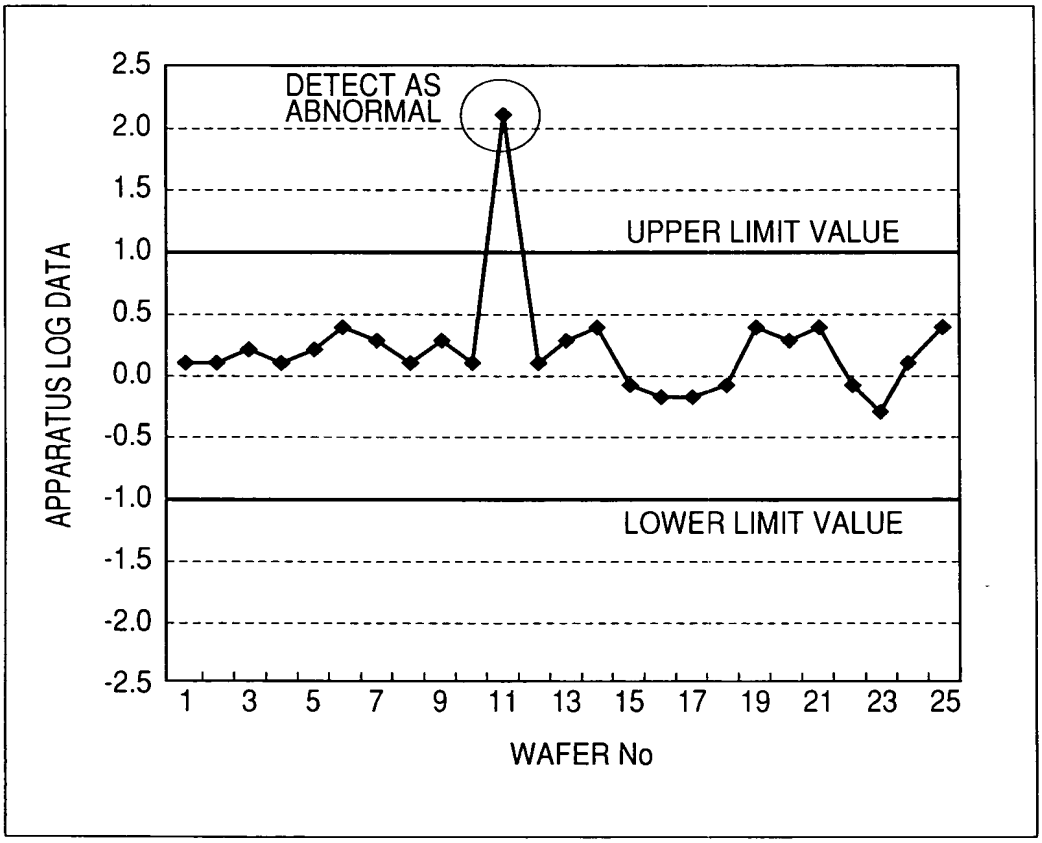

DETECT AS ABNORMAL
UPPER LIMIT VALUE
LOWER LIMIT VALUE
APPARATUS LOG DATA
WAFER No
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
1
3
5
7
9
11
13
15
17
19
21
23
25

FIG. 4

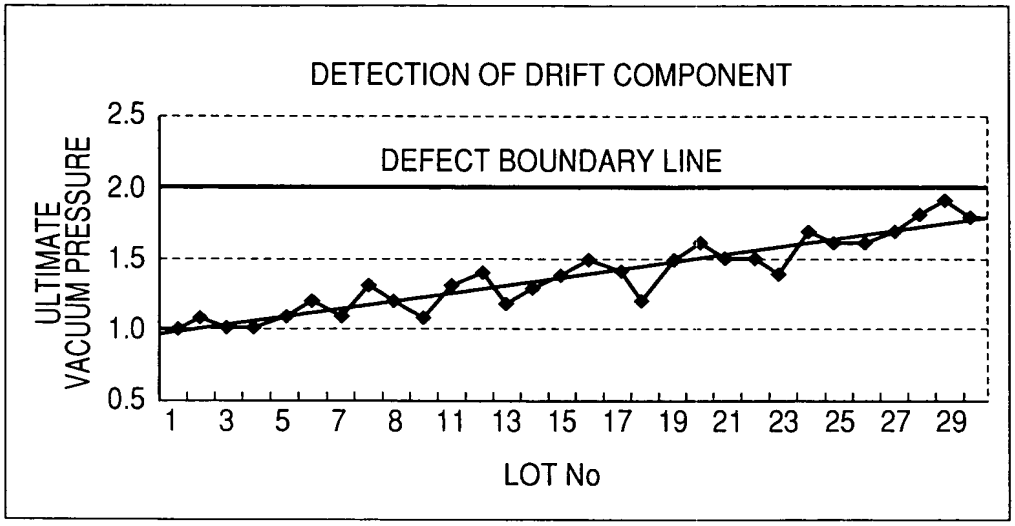

DETECTION OF DRIFT COMPONENT
DEFECT BOUNDARY LINE
ULTIMATE VACUUM PRESSURE
2.5
2.0
1.5
1.0
0.5
1 3 5 7 8 11 13 15 17 19 21 23 25 27 29
LOT No

FIG. 5

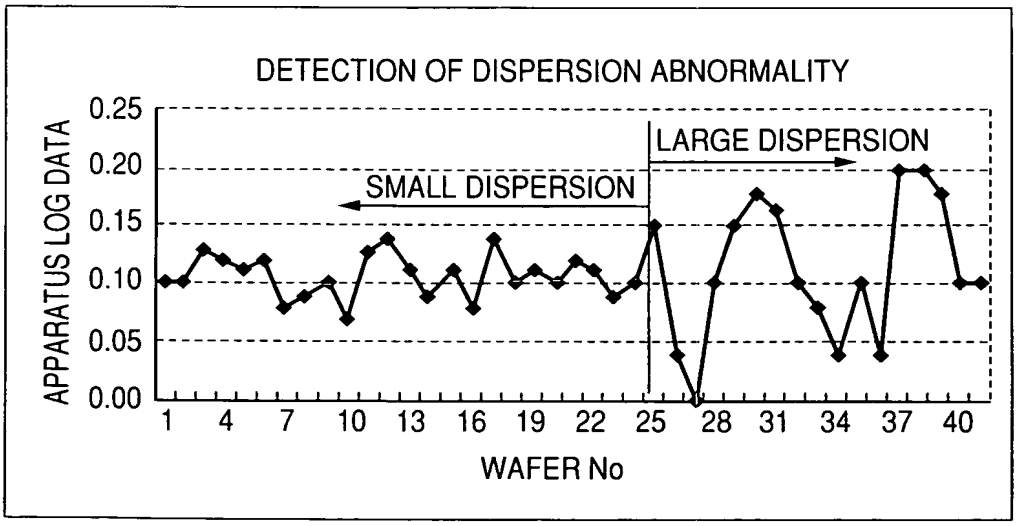

DETECTION OF DISPERSION ABNORMALITY
LARGE DISPERSION
SMALL DISPERSION
APPARATUS LOG DATA
0.25
0.20
0.15
0.10
0.05
0.00
1 4 7 10 13 16 19 22 25 28 31 34 37 40
WAFER No

FIG. 6

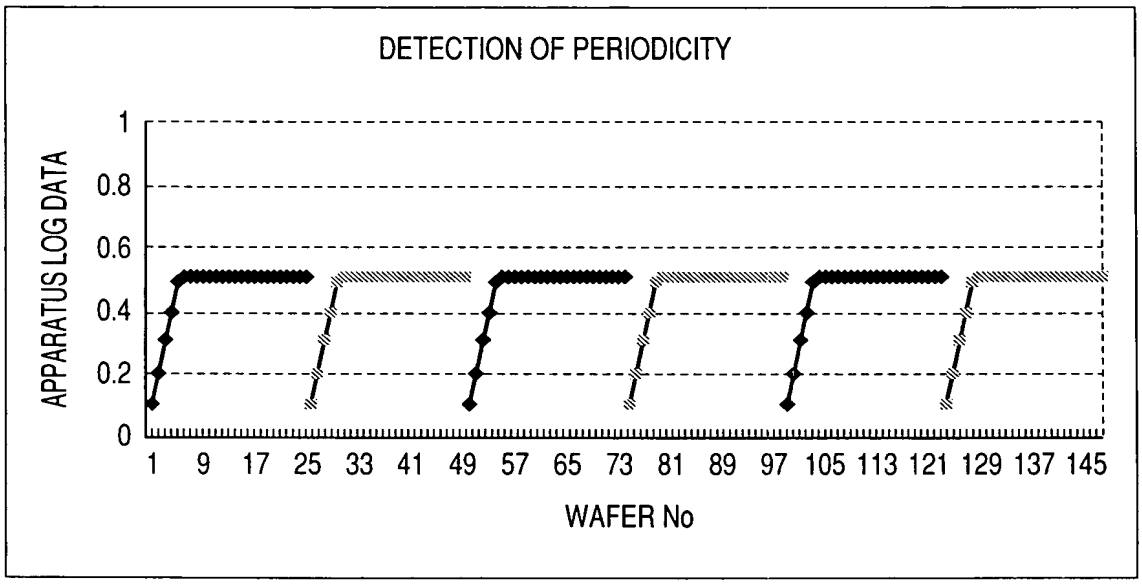

DETECTION OF PERIODICITY
APPARATUS LOG DATA
1
0.8
0.6
0.4
0.2
0
1 9 17 25 33 41 49 57 65 73 81 89 97 105 113 121 129 137 145
WAFER No

FIG. 7

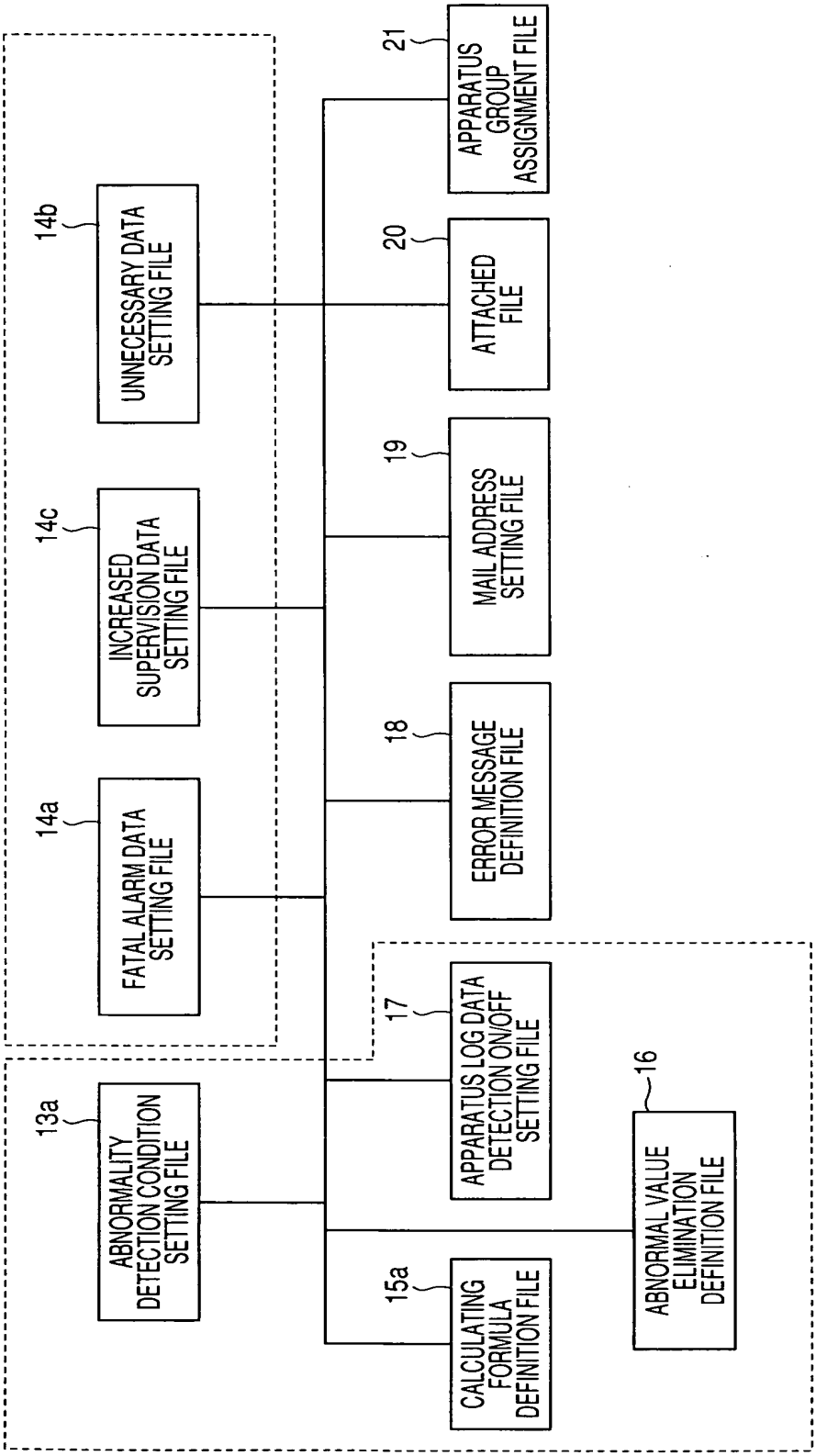

14a
FATAL ALARM DATA SETTING FILE
14b
UNNECESSARY DATA SETTING FILE
14c
INCREASED SUPERVISION DATA SETTING FILE
13a
ABNORMALITY DETECTION CONDITION SETTING FILE
15a
CALCULATING FORMULA DEFINITION FILE
16
ABNORMAL VALUE ELIMINATION DEFINITION FILE
17
APPARATUS LOG DATA DETECTION ON/OFF SETTING FILE
18
ERROR MESSAGE DEFINITION FILE
19
MAIL ADDRESS SETTING FILE
20
ATTACHED FILE
21
APPARATUS GROUP ASSIGNMENT FILE

FIG. 8

	SEARCH KEY								APPARATUS LOG DATA SETTING PORTION			
No	RECIPE No		APPARATUS NAME		CHAMBER	STEP ID	PRODUCT NAME	PROCESS NAME	PARAMETER SETTING REFERENCE COLUMN	OPERATOR TERMINAL DISPLAY ON/OFF	MAILING ADDRESS	APPARATUS LOG DATA APPARATUS SIDE NAME
	SEARCH FOR	ELIMINATE	SETTING KEY	SEARCH KEY								
1			A	Key			Key	Key		ON	ALL MEMBERS	G1
2			A	Key			Key	Key		ON	ALL MEMBERS	G2
3			B	Key			Key	Key		ON	ALL MEMBERS	G3
4			B	Key			Key	Key		ON	ALL MEMBERS	G4
5			A-I	Key			Key	Key		ON	ALL MEMBERS	G5
6			A-KrF	Key			Key	Key		ON	ALL MEMBERS	G6

COMMON					NUMBER OF SEARCH DATA		σ ABNORMALITY JUDGMENT		UPPER AND LOWER LIMIT VALUE JUDGMENT			WIDTH ABNORMALITY JUDGMENT		REFERENCE COLUMN
JUDGMENT METHOD	ERROR MESSAGE	ATTACHED FILE	RESET FLAG DURING APPARATUS MAINTE-NANCE	REGISTERED DATE	MINIMUM DATA NUMBER	MAXIMUM DATA NUMBER	JUDGMENT ON/OFF	σ COEFFICIENT	JUDGMENT ON/OFF	UPPER THRESHOLD VALUE	LOWER THRESHOLD VALUE	JUDGMENT ON/OFF	NORMAL WIDTH	
WITHIN LOT	1	101		2003/1/31	3	25	ON	3						
WITHIN LOT	1	101		2003/1/31	3	25	ON	3						
WITHIN LOT	1			2003/1/31	3	25	ON	3						
WITHIN LOT	1			2003/1/31	3	25	ON	3						
CONTINUOUS	4			2003/1/31					ON	0.05	0.01			
CONTINUOUS	6			2003/1/31					ON	0.05	0.01			

FIG. 9

APPARATUS NAME	SEMICONDUCTOR MAKER	WAVELENGTH	APPARATUS GROUPING NAME					
			A	B	A-I	A-KrF	B-I	B-KrF
F-01	A	I LINE	○		○			
F-02	A	I LINE	○		○			
F-03	A	I LINE	○		○			
F-04	A	I LINE	○		○			
F-05	A	I LINE	○		○			
E-01	A	KrF	○			○		
E-02	A	KrF	○			○		
E-03	A	KrF	○			○		
E-04	A	KrF	○			○		
N-01	B	I LINE		○			○	
N-02	B	I LINE		○			○	
N-03	B	I LINE		○			○	
N-04	B	I LINE		○			○	
E-08	B	KrF		○				○
E-09	B	KrF		○				○
E-10	B	KrF		○				○
E-11	B	KrF		○				○
E-12	B	KrF		○				○

FIG. 10

		APPARATUS LOG DATA									
APPARATUS CODE	APPARATUS NAME	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10
24042	F-01	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	ON
2404L	F-02	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	ON
2404M	F-03	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	ON
2404N	F-04	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	ON
2404O	F-05	ON	ON	OFF	OFF	ON	ON	ON	ON	ON	ON
2404H	E-01	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
2404D	E-02	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
2404E	E-03	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF

FIG. 11

KIND OF APPARATUS LOG DATA	PRODUCT	PROCESS	APPARATUS	LOWER LIMIT	UPPER LIMIT
GLOBAL ALIGNMENT MEASUREMENT SHIFT X	α	1	#1	0.1	0.5
		2		0	0.8
		3		0.4	1
		4		0.8	1.2
		1	#2	0.2	0.6
		2		-0.5	-0.3
		3		0.1	0.8
		4		1.2	1.8

FIG. 12

KIND OF APPARATUS LOG DATA	PRODUCT NAME	PROCESS NAME	APPARATUS NAME	σ COEFFICIENT
GLOBAL ALIGNMENT MEASUREMENT SHIFT X	key	key	key	3

FIG. 13

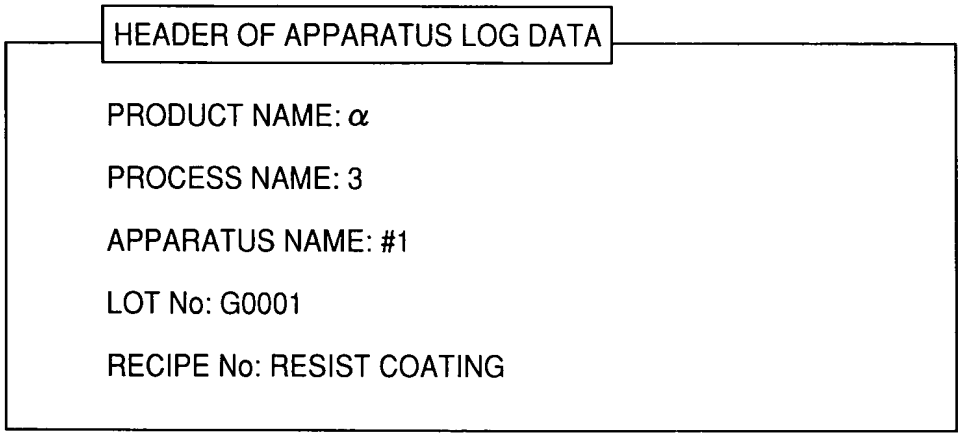

HEADER OF APPARATUS LOG DATA
PRODUCT NAME: α
PROCESS NAME: 3
APPARATUS NAME: #1
LOT No: G0001
RECIPE No: RESIST COATING

FIG. 14

No	CONTENT OF DETECTION ITEM	CALCULATING FORMULA	PARAMETER P1 FOR CALCULATION	PARAMETER P2 FOR CALCULATION	PARAMETER P3 FOR CALCULATION	PARAMETER P4 FOR CALCULATION
1	PARAMETER Z	(Ch1+Ch4)/2-(Ch2+Ch5)/2	Ch1	Ch2	Ch4	Ch5

FIG. 15

ERROR No	SUMMARY DISPLAY	CONTENT OF ERROR MESSAGE
1	ALIGNMENT ABNORMALITY	THERE IS AN ABNORMALITY IN AN ALIGNMENT MEASUREMENT RESULT. SINCE AN ALIGNMENT SHIFT MAY OCCUR, INSPECT ALIGNMENT OF AN ABNORMAL WAFER. SEND OUT WHEN THERE IS NO ABNORMALITY IN THE ALIGNMENT INSPECTION RESULT. FREQUENT OCCURRENCE REQUIRES A NOTIFICATION TO (MANUFACTURING TECHNOLOGY SECTION).
2	ALIGNMENT ABNORMALITY	THERE IS AN ABNORMALITY IN A BLC MEASUREMENT VALUE. SINCE AN ALIGNMENT SHIFT MAY OCCUR, INSPECT ALIGNMENT OF AN ABNORMAL LOT. WHEN A SHUTDOWN OR INITIALIZATION IS CAUSED DURING A PROCESS OF A LOT, INSPECT WAFERS BEFORE AND AFTER THAT. SEND OUT WHEN THERE IS NO ABNORMALITY IN THE ALIGNMENT INSPECTION RESULT. FREQUENT OCCURRENCE REQUIRES A NOTIFICATION TO (MANUFACTURING TECHNOLOGY SECTION).
3	FOCUS ABNORMALITY	THERE IS AN ABNORMALITY IN A FOCUS MEASUREMENT VALUE. SINCE A FOCUS SHIFT MAY OCCUR, CARRY OUT A DIMENSION INSPECTION AND FOCUS QC. WHEN A SHUTDOWN OR INITIALIZATION IS CAUSED DURING A PROCESS OF A LOT, INSPECT WAFERS BEFORE AND AFTER THAT. WRITE IN APPARATUS QC DATA IN A COMMENT COLUMN. FREQUENT OCCURRENCE REQUIRES A NOTIFICATION TO (MANUFACTURING TECHNOLOGY SECTION).

FIG. 16

A STEPPER MEASUREMENT ABNORMALITY OCCURRED.
SINCE AN OFF-SPECIFICATION ALIGNMENT MAY OCCUR, CARRY OUT AN ALIGNMENT MEASUREMENT.
WRITE IN A CONCERNED PRODUCT IN A TABLE BELOW AND RETURN.

ATTACHED FILE No: 101

LOT No	WAFER No	DETECTION ITEM	CONTENT OF OPERATION		X DIRECTION			Y DIRECTION		
					SPECIFICATION	MEASUREMENT RESULT	JUDGMENT RESULT	SPECIFICATION	MEASUREMENT RESULT	JUDGMENT RESULT
		GLOBAL ALIGNMENT MEASUREMENT DATA	IMPLEMENTATION OF ALIGNMENT INSPECTION	UPPER LIMIT						
				LOWER LIMIT						

RETURN

FIG. 17

No	FATAL ALARM DATA	INPUTTER	TERMINAL DISPLAY ON/OFF	MAIL ADDRESS	ALARM CONTENT	CONTENT OF ENGINEER'S INSTRUCTION
1	A0001		ON	ENGINEER		
2	A0002		ON	ENGINEER		
3	A0003		ON	ENGINEER		
4	B0***		ON	ENGINEER		

FIG. 18

No	UNNECESSARY DATA	INPUTTER
1	X0001	
2	X0002	
3	Y00**	

FIG. 19

No	INCREASED SUPERVISION DATA	SUPERVISION TIME	NUMBER OF TIMES	INPUTTER	TERMINAL DISPLAY ON/OFF	MAILING ADDRESS	CONTENT OF ENGINEER'S INSTRUCTION
1	Z0001	2	10		ON	ENGINEER	
2	Z0002	2	5		ON	ENGINEER	
3	DEFAULT	1	10		ON	ENGINEER	

FIG. 20

ELEMENT	IMPLA
START TIME	2003/1/10 10:10
COMPLETION TIME	2003/1/10 11:00
PRODUCT NAME	A
PROCESS NAME	X
RECIPE NAME	A-X
APPARATUS NAME	HE-01
LOT No	A0001
CHAMBER NAME	
STEP NAME	
APPARATUS ERROR	YES

ERROR MESSAGE No	CONTENT OF ERROR MESSAGE	CHECK FILE	CONCERNED PRODUCT
1	A PRESSURE ABNORMALITY IS DETECTED. CONFIRM A CONTENT OF AN ATTACHED FILE AND SEND OUT THE LOT.	NONE	OPEN
2	AN INJECTION CURRENT ABNORMALITY IS DETECTED. CONFIRM A CONTENT OF AN ATTACHED FILE AND SEND OUT THE LOT.	YES	OPEN

FIG. 21

APPARATUS ERROR FILE

APPARATUS ERROR	OCCURRENCE TIME PERIOD	15:30
	WAFER No	10
	CODE	****-******
	CONTENT	VACUUM PRESSURE ABNORMALITY
APPARATUS ERROR	OCCURRENCE TIME PERIOD	15:40
	WAFER No	15
	CODE	****-******
	CONTENT	VACUUM PRESSURE ABNORMALITY

FIG. 22

LOT No	WAFER No	DETECTION ITEM	DETECTION METHOD
A001	1	VACUUM PRESSURE	UPPER AND LOWER LIMIT VALUES
A001	5, 10	INJECTION CURRENT	WIDTH JUDGMENT

FIG. 23

No	CONTENT OF CONFIRMATION	MANAGEMENT SPECIFICATION			MANAGEMENT VALUE	JUDGMENT
		UNIT	LOWER LIMIT	UPPER LIMIT		
1	VACUUM OF BEAM LINE (NO LOAD)	E-6Torr	–	1.00	0.56	OK
2	VACUUM OF BEAM LINE (WITH GATE VALVE OF CRYO CLOSED)	E-6Torr	0.11	–		
3	VACUUM OF ANALYZER (WITH BEAM GATE IN UNDER NO LOAD)	E-6Torr	–	1.00		
4	VACUUM OF ANALYZER (WITH BEAM GATE OUT UNDER NO LOAD)	E-6Torr	–	1.00		
5	VACUUM OF BEAM LINE (DURING IMPLEMENTATION OF P-RS DUMMY INJECTION)	E-6Torr	–	1.00		
	WHETHER ERROR OCCURRED OR NOT (DURING IMPLEMENTATION OF P-RS DUMMY INJECTION)	–	–	–		
6	VACUUM OF BEAM LINE (DURING IMPLEMENTATION OF P-RS 30 DUMMY INJECTION)	E-6Torr	–	1.00		
	WHETHER ERROR OCCURRED OR NOT (DURING IMPLEMENTATION OF P-RS DUMMY INJECTION)	–	–	–		

RETURN

FIG. 24

CHECK BOX	OCCURRENCE TIME PERIOD	KIND OF ERROR	APPARATUS ALARM DATA	LOT No	WAFER No	CONTENT OF ALARM	ENGINEER'S INSTRUCTION
☑	4/1 13:00	FATAL ERROR	****-****	A0001	01	VACUUM PRESSURE ABNORMALITY	STOP A UNIT AND NOTIFY TO (APPARATUS MANAGEMENT SECTION). STOP THE PRODUCT.
☑	4/1 13:15	FATAL ERROR	****-****	A0001	03	VACUUM PRESSURE ABNORMALITY	STOP A UNIT AND NOTIFY TO (APPARATUS MANAGEMENT SECTION). STOP THE PRODUCT.
☑	4/1 13:30	FATAL ERROR	****-****	A0001	05	VACUUM PRESSURE ABNORMALITY	STOP A UNIT AND NOTIFY TO (APPARATUS MANAGEMENT SECTION). STOP THE PRODUCT.
☐	4/1 13:45	FATAL ERROR	****-****	A0001	10	CURRENT VALUE ABNORMALITY	STOP A UNIT AND NOTIFY TO AN ENGINEER.
☐	4/1 14:30	ABNORMALITY IN NUMBER OF TIMES	****-****	A0001	20	GAS FLOW RATE ABNORMALITY	THE ERROR OCCURS FREQUENCY. STOP A UNIT AND NOTIFY TO (APPARATUS MANAGEMENT SECTION).

RETURN

FIG. 25

TRANSMISSION	OCCURRENCE TIME PERIOD	LOT No	WAFER No	CONTENT OF ALARM	LINE COMMENT INPUT COLUMN
☑	4/1 13:00	A0001	01	VACUUM PRESSURE ABNORMALITY	THERE IS NO PROBLEM OF CHECK POINTS OF A VALVE AND VACUUM GAUGE. STAFFS AGREE FLOWING PRODUCTS.
☑	4/1 13:15	A0001	03	VACUUM PRESSURE ABNORMALITY	THERE IS NO PROBLEM OF CHECK POINTS OF A VALVE AND VACUUM GAUGE. STAFFS AGREE FLOWING PRODUCTS.
☑	4/1 13:30	A0001	05	VACUUM PRESSURE ABNORMALITY	THERE IS NO PROBLEM OF CHECK POINTS OF A VALVE AND VACUUM GAUGE. STAFFS AGREE FLOWING PRODUCTS.

INPUT END

FIG. 26

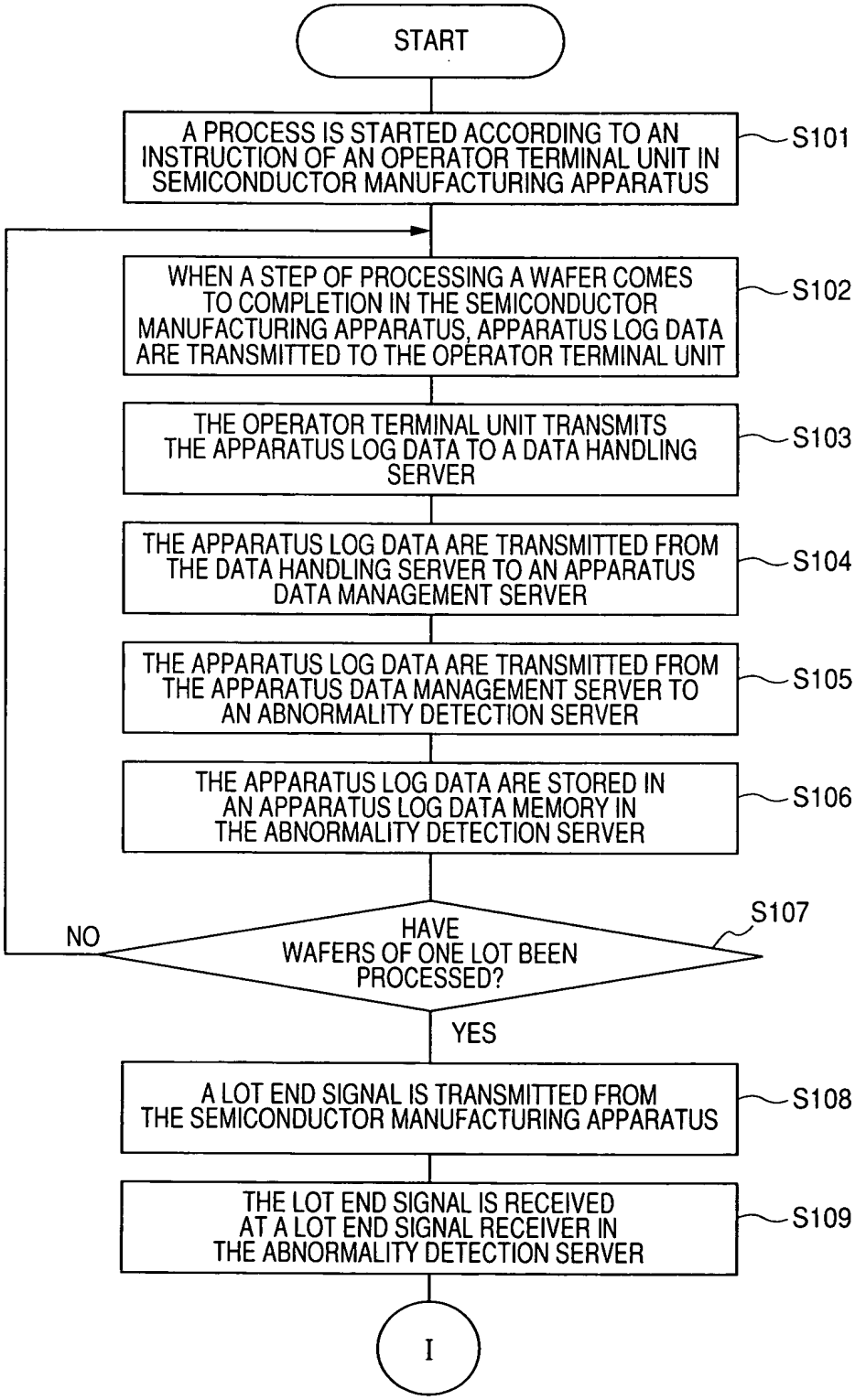

START
A PROCESS IS STARTED ACCORDING TO AN INSTRUCTION OF AN OPERATOR TERMINAL UNIT IN SEMICONDUCTOR MANUFACTURING APPARATUS
S101
WHEN A STEP OF PROCESSING A WAFER COMES TO COMPLETION IN THE SEMICONDUCTOR MANUFACTURING APPARATUS, APPARATUS LOG DATA ARE TRANSMITTED TO THE OPERATOR TERMINAL UNIT
S102
THE OPERATOR TERMINAL UNIT TRANSMITS THE APPARATUS LOG DATA TO A DATA HANDLING SERVER
S103
THE APPARATUS LOG DATA ARE TRANSMITTED FROM THE DATA HANDLING SERVER TO AN APPARATUS DATA MANAGEMENT SERVER
S104
THE APPARATUS LOG DATA ARE TRANSMITTED FROM THE APPARATUS DATA MANAGEMENT SERVER TO AN ABNORMALITY DETECTION SERVER
S105
THE APPARATUS LOG DATA ARE STORED IN AN APPARATUS LOG DATA MEMORY IN THE ABNORMALITY DETECTION SERVER
S106
HAVE WAFERS OF ONE LOT BEEN PROCESSED?
S107
NO
YES
A LOT END SIGNAL IS TRANSMITTED FROM THE SEMICONDUCTOR MANUFACTURING APPARATUS
S108
THE LOT END SIGNAL IS RECEIVED AT A LOT END SIGNAL RECEIVER IN THE ABNORMALITY DETECTION SERVER
S109
I

FIG. 27

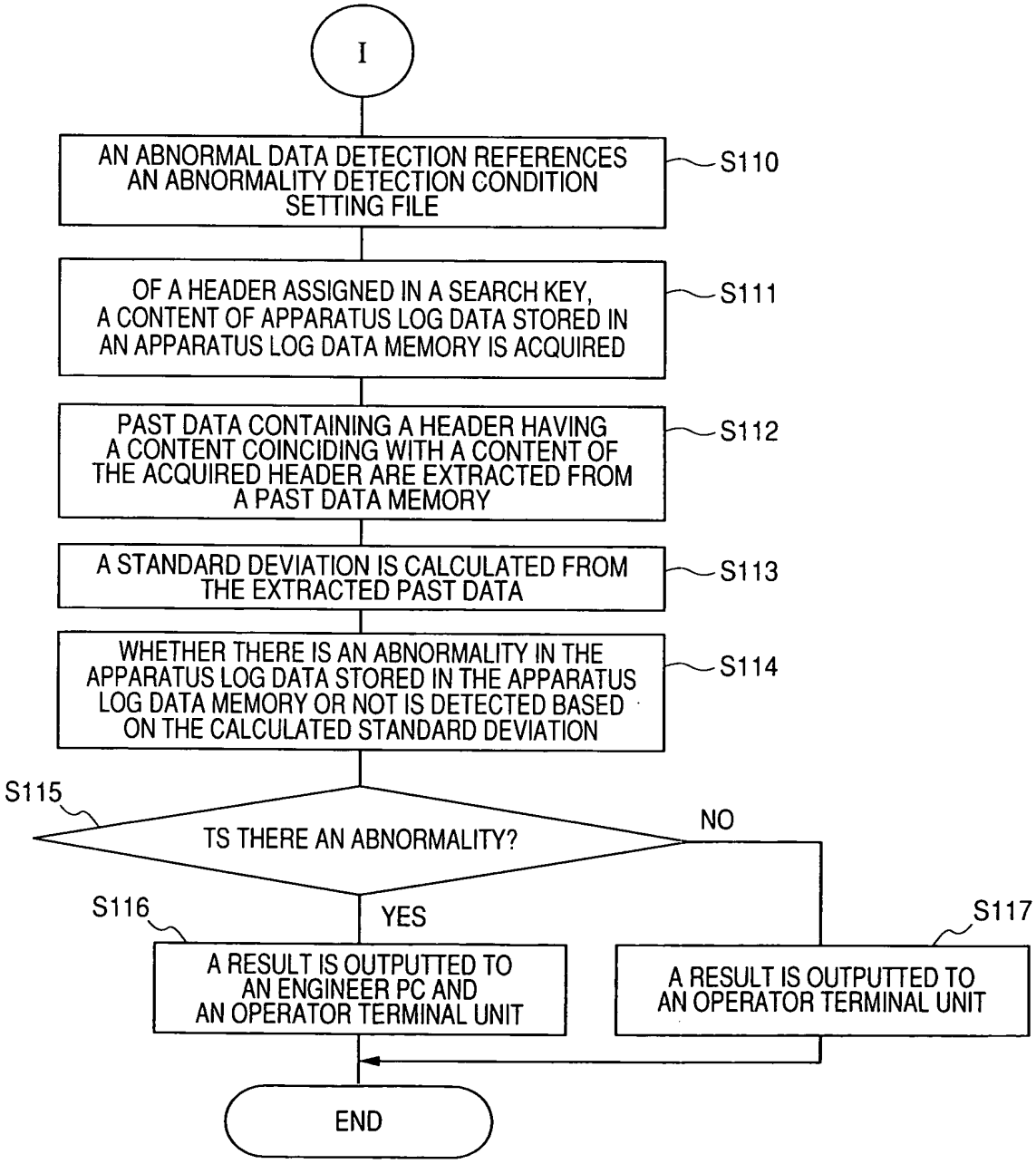

I
AN ABNORMAL DATA DETECTION REFERENCES AN ABNORMALITY DETECTION CONDITION SETTING FILE
S110
OF A HEADER ASSIGNED IN A SEARCH KEY, A CONTENT OF APPARATUS LOG DATA STORED IN AN APPARATUS LOG DATA MEMORY IS ACQUIRED
S111
PAST DATA CONTAINING A HEADER HAVING A CONTENT COINCIDING WITH A CONTENT OF THE ACQUIRED HEADER ARE EXTRACTED FROM A PAST DATA MEMORY
S112
A STANDARD DEVIATION IS CALCULATED FROM THE EXTRACTED PAST DATA
S113
WHETHER THERE IS AN ABNORMALITY IN THE APPARATUS LOG DATA STORED IN THE APPARATUS LOG DATA MEMORY OR NOT IS DETECTED BASED ON THE CALCULATED STANDARD DEVIATION
S114
S115
TS THERE AN ABNORMALITY?
NO
YES
S116
A RESULT IS OUTPUTTED TO AN ENGINEER PC AND AN OPERATOR TERMINAL UNIT
S117
A RESULT IS OUTPUTTED TO AN OPERATOR TERMINAL UNIT
END

FIG. 28

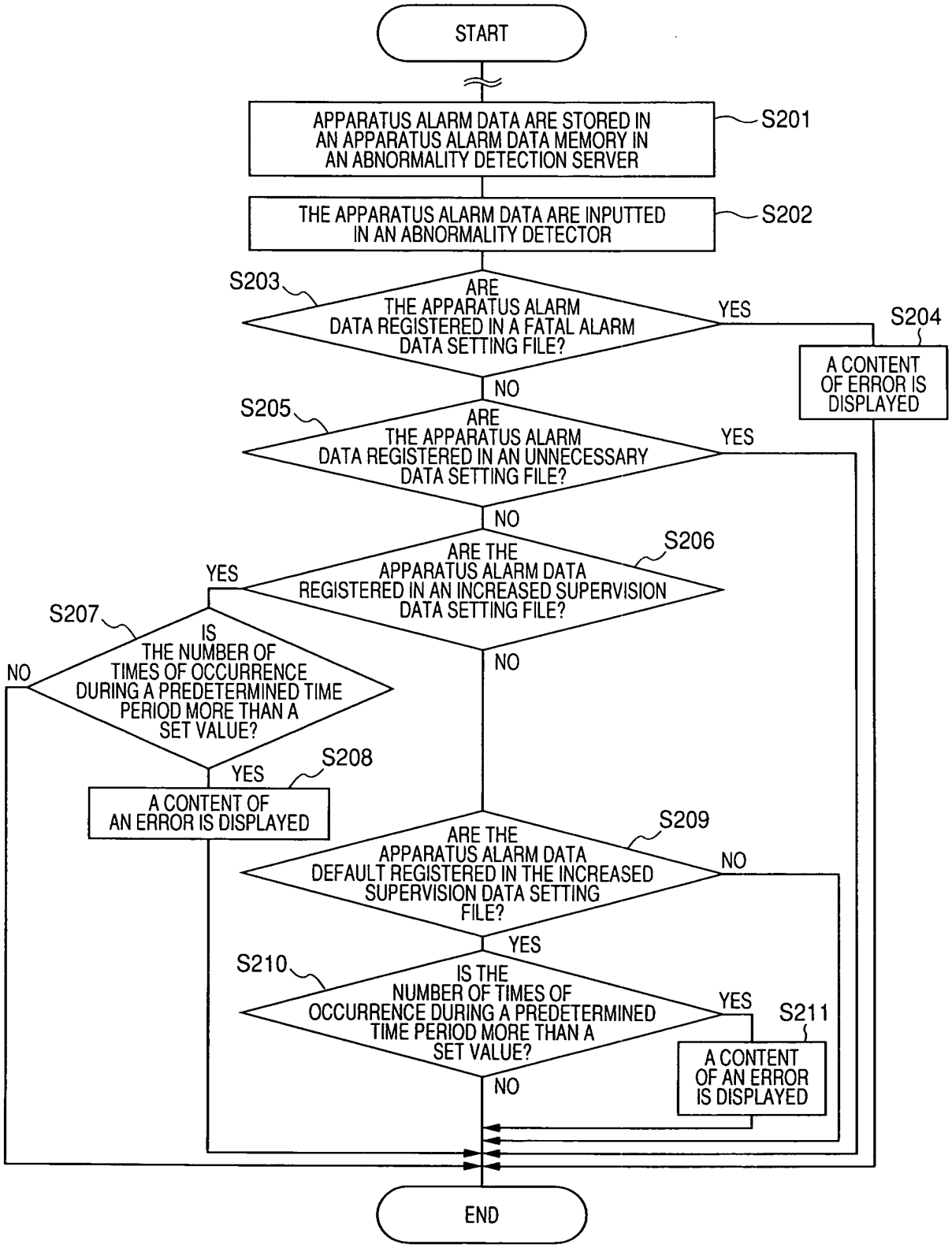

START
APPARATUS ALARM DATA ARE STORED IN AN APPARATUS ALARM DATA MEMORY IN AN ABNORMALITY DETECTION SERVER
S201
THE APPARATUS ALARM DATA ARE INPUTTED IN AN ABNORMALITY DETECTOR
S202
S203
ARE THE APPARATUS ALARM DATA REGISTERED IN A FATAL ALARM DATA SETTING FILE?
YES
S204
A CONTENT OF ERROR IS DISPLAYED
NO
S205
ARE THE APPARATUS ALARM DATA REGISTERED IN AN UNNECESSARY DATA SETTING FILE?
YES
NO
S206
ARE THE APPARATUS ALARM DATA REGISTERED IN AN INCREASED SUPERVISION DATA SETTING FILE?
YES
NO
S207
IS THE NUMBER OF TIMES OF OCCURRENCE DURING A PREDETERMINED TIME PERIOD MORE THAN A SET VALUE?
NO
YES
S208
A CONTENT OF AN ERROR IS DISPLAYED
S209
ARE THE APPARATUS ALARM DATA DEFAULT REGISTERED IN THE INCREASED SUPERVISION DATA SETTING FILE?
NO
YES
S210
IS THE NUMBER OF TIMES OF OCCURRENCE DURING A PREDETERMINED TIME PERIOD MORE THAN A SET VALUE?
YES
S211
A CONTENT OF AN ERROR IS DISPLAYED
NO
END

FIG. 29

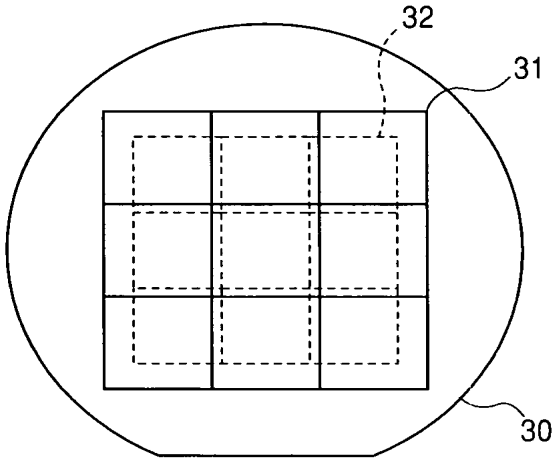

32
31
30

FIG. 30

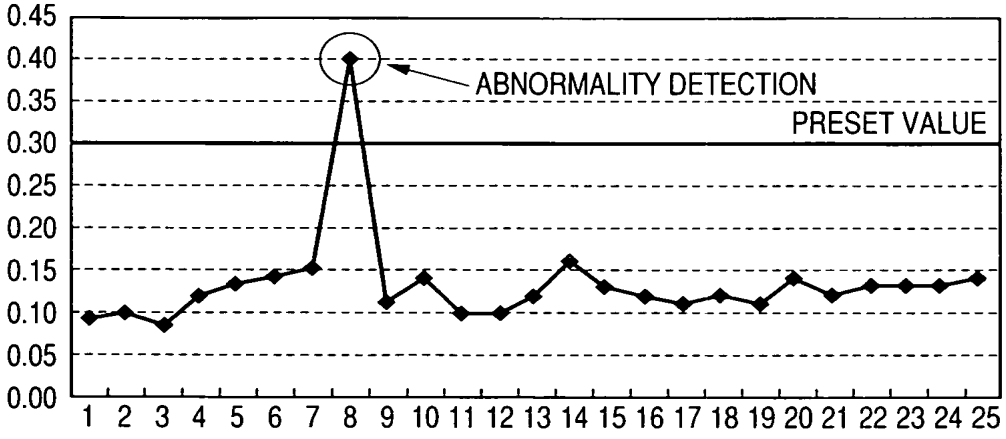

0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
ABNORMALITY DETECTION
PRESET VALUE
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

FIG. 31

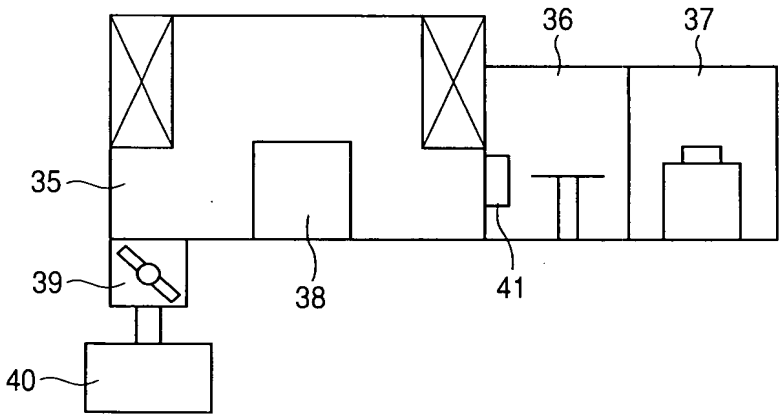


FIG. 32

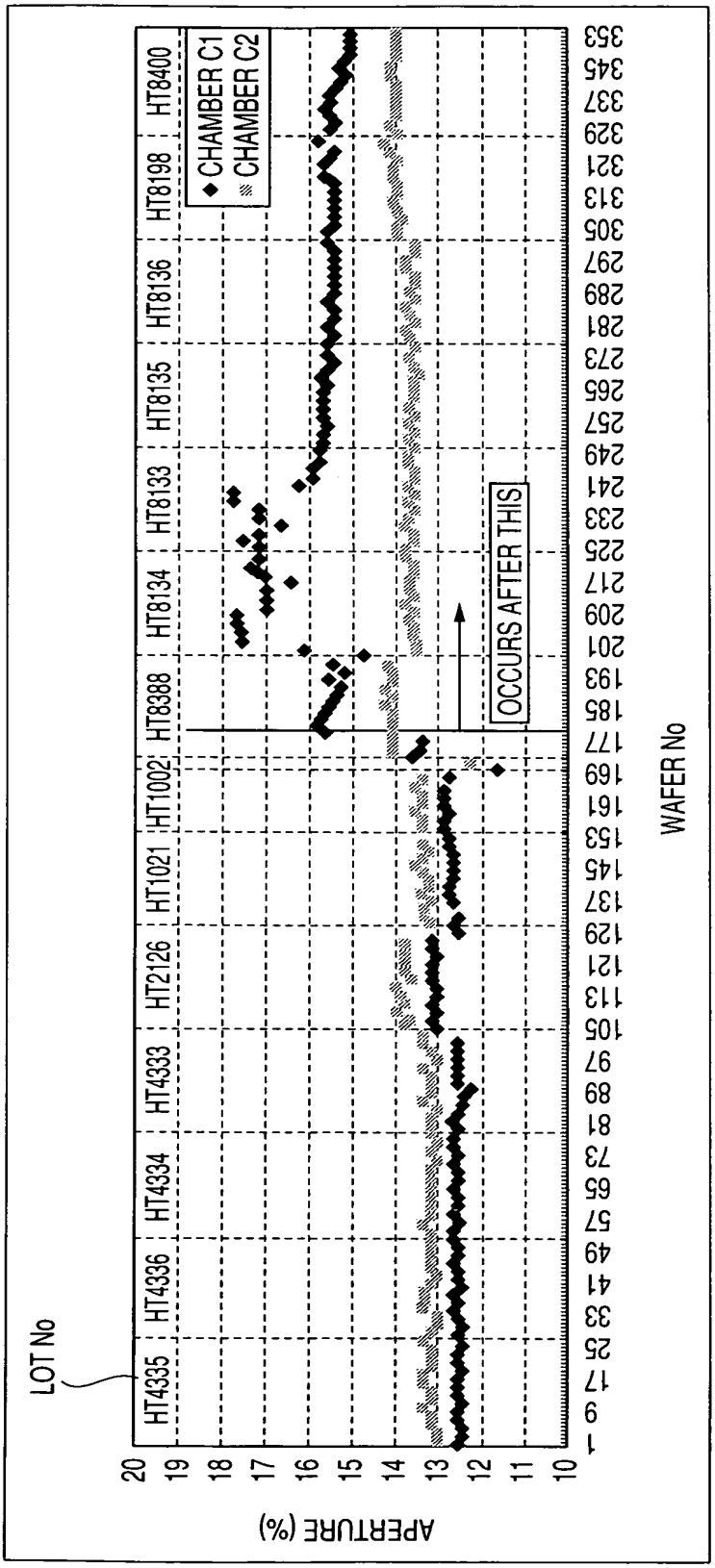

LOT No
HT4335
HT4336
HT4334
HT4333
HT2126
HT1021
HT1002
HT8388
HT8134
HT8133
HT8135
HT8136
HT8198
HT8400
CHAMBER C1
CHAMBER C2
OCCURS AFTER THIS
APERTURE (%)
WAFER No

FIG. 33

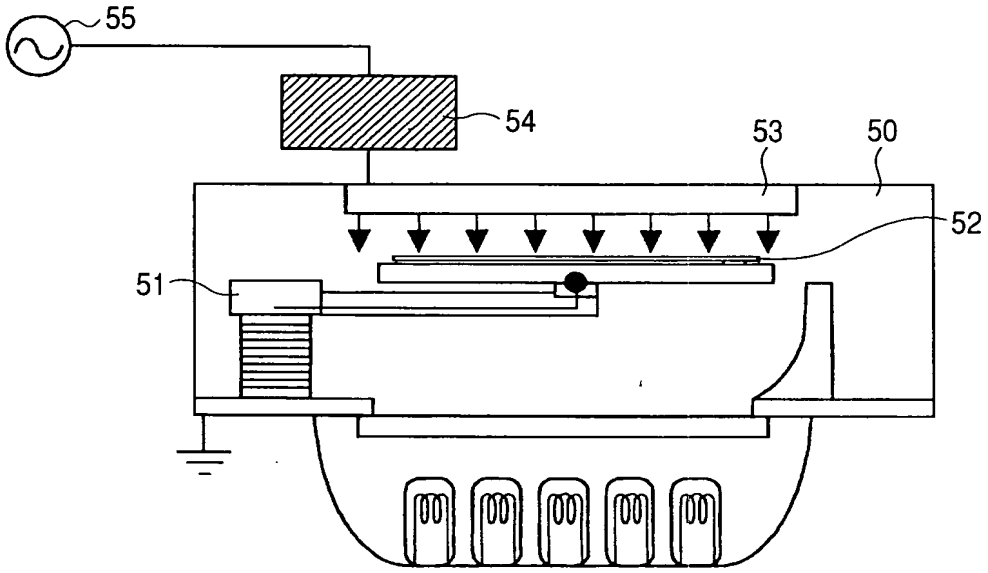

55
54
53
50
52
51

FIG. 34

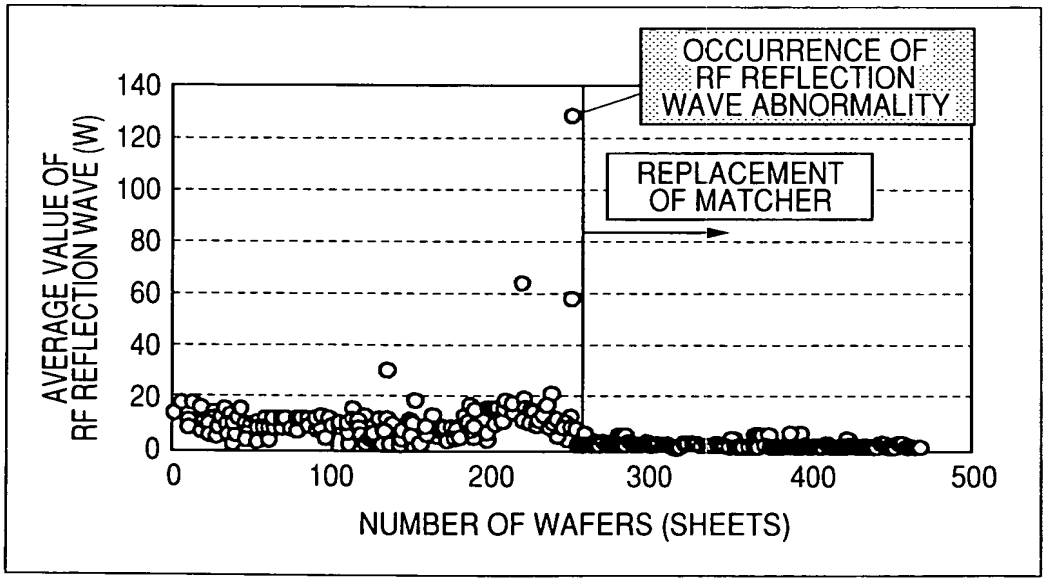

OCCURRENCE OF RF REFLECTION WAVE ABNORMALITY
REPLACEMENT OF MATCHER
AVERAGE VALUE OF RF REFLECTION WAVE (W)
140
120
100
80
60
40
20
0
0
100
200
300
400
500
NUMBER OF WAFERS (SHEETS)

FIG. 35

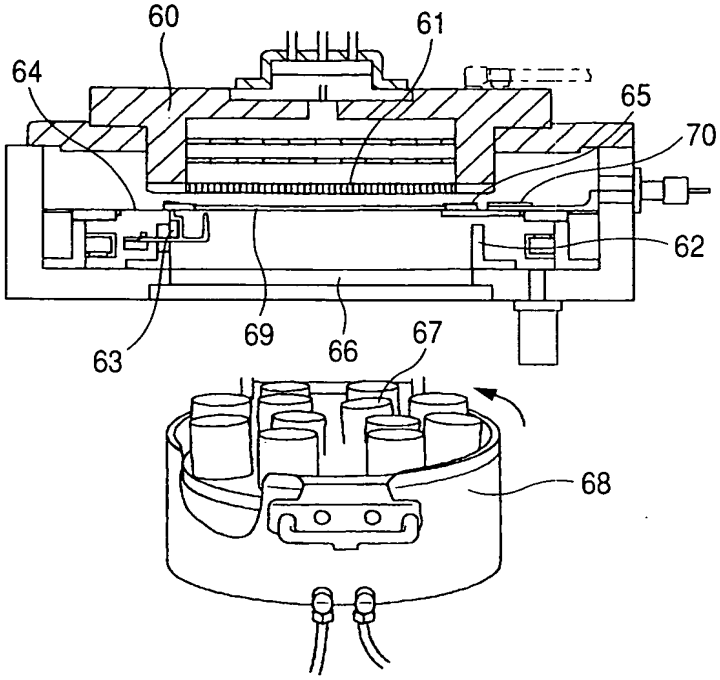
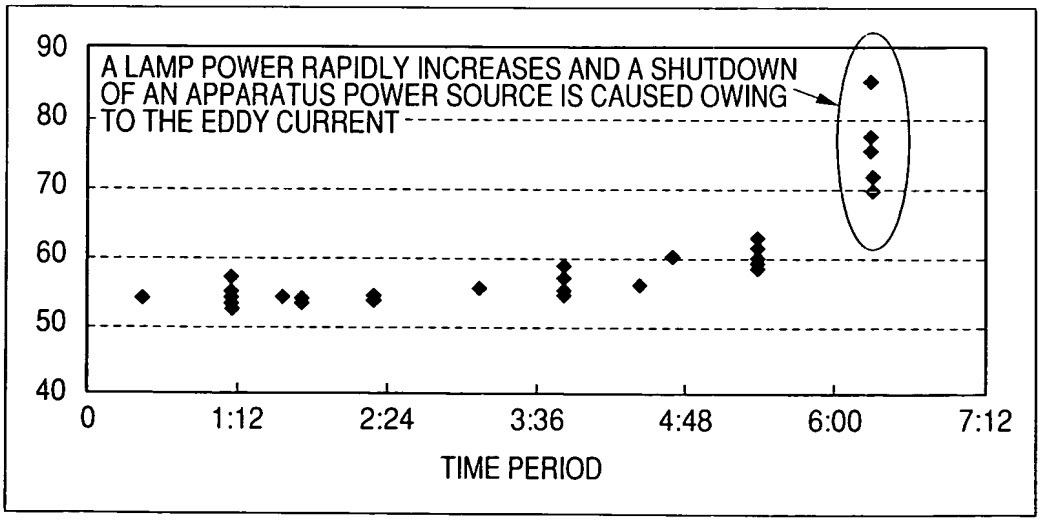

60
61
64
65
70
62
63
69
66
67
68

FIG. 36


90
80
70
60
50
40
A LAMP POWER RAPIDLY INCREASES AND A SHUTDOWN OF AN APPARATUS POWER SOURCE IS CAUSED OWING TO THE EDDY CURRENT
0
1:12
2:24
3:36
4:48
6:00
7:12
TIME PERIOD